

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

March 11, 2019

Engine Data Monitor (EDM)

Specialist's Factual Report
By Christopher Babcock

1. EVENT SUMMARY

Location: Greenville, Maine
Date: July 30, 2018
Aircraft: Piper PA-60-602P
Registration: C-GRRS
Operator: Private
NTSB Number: ERA18FA206

On July 30, 2018, about 1055 eastern daylight time, a Canadian registered Piper PA-60-602P, C-GRRS, was destroyed when it impacted terrain while on approach to land at the Greenville Municipal Airport (3B1), Greenville, Maine. The private pilot and the two passengers were fatally injured. The airplane was registered to and operated by the pilot under Canadian Aviation Regulations as a recreational flight. An instrument flight rules flight plan was filed for the flight that departed the Pembroke Airport (CYTA), Pembroke, Ontario, Canada, about 0905, and was destined for the Charlottetown Airport (CYYG), Prince Edward Island, Canada. Visual meteorological conditions prevailed at the of the accident.

2. ENGINE DATA MONITOR GROUP

An Engine Data Monitor (EDM) group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following EDMs:

Recorder Manufacturer/Model: **JPI EDM-760**
Recorder Serial Number: **1105**

Recorder Manufacturer/Model: **Shadin Fuel Flow Indicator**
Recorder Serial Number: **9618**

3.1. EDM 760 Description

The J. P. Instruments EDM-760 is a panel mounted gauge that the operator can monitor and record up to 24 parameters related to twin engine operations. Depending on the installation engine parameters monitored, for both engines, can include:

- Exhaust Gas Temperature (EGT)
- Cylinder Head Temperature (CHT)
- Oil Pressure and Temperature
- Manifold Pressure

- Outside Air Temperature
- Turbine inlet Temperature
- Engine Revolutions per Minute
- Compressor Discharge Temperature
- Fuel Flow
- Carburetor Temperature
- Battery Voltage

The unit can also calculate, in real-time, horsepower, fuel used, shock cooling rate and EGT differentials between the highest and lowest cylinder temperatures. The calculations are also based on the aircraft installation.

The unit contains non-volatile memory for data storage of the parameters recorded and calculated.¹ The rate at which the data is stored is selectable by the operator from 2 to 500 seconds per sample. The memory can store up to 20 hours of data at a 6 second sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

3.1.1. EDM-760 Data Recovery

The recorder sustained severe impact damage during the accident. The extent of the damage is shown in Figure 1. Five non-volatile memory devices were removed and imaged using laboratory equipment.

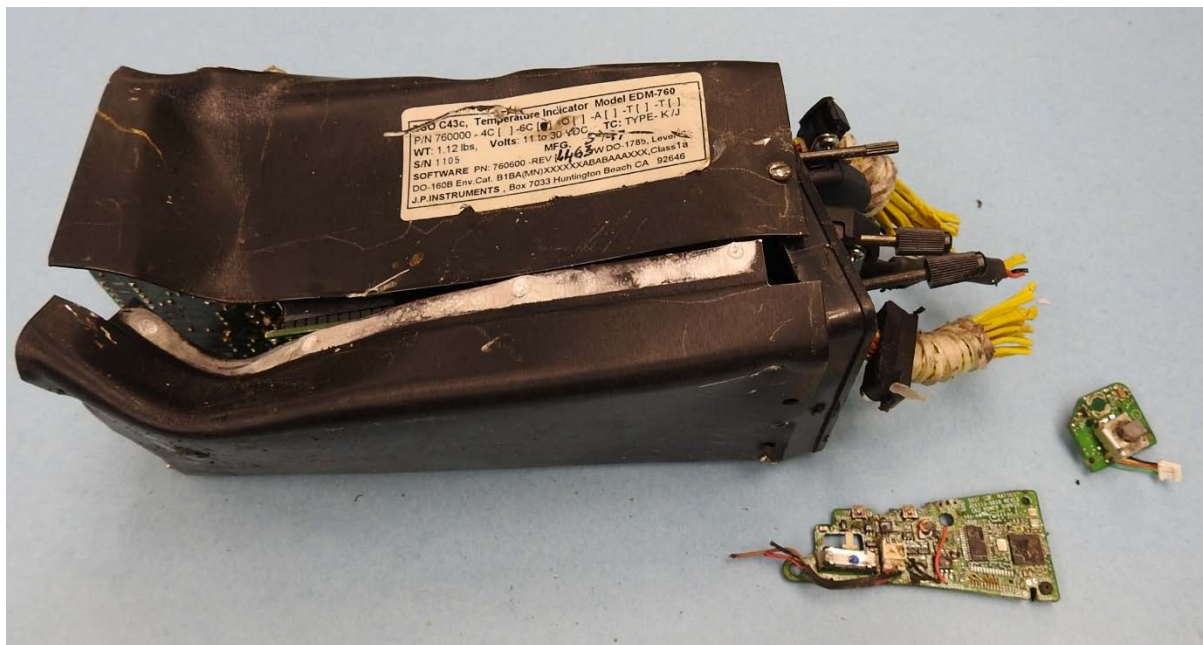


Figure 1. Damaged exterior of EDM.

3.1.2. Data Description

The EDM recording contained from July 16, 2018, through the accident flight. The event flight was the last flight of the recording and its duration was approximately 1 hour and 50 minutes.

¹ Non-volatile memory is semiconductor memory that does not require power to retain information

3.1.3. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation from the manufacturer of the EDM.

Appendix A lists the EDM parameters verified and provided in this report.

3.2. Shadin Fuel Flow Indicator Description

The Shadin Fuel Flow Indicator is a digital fuel management system designed to provide fuel management information under real-time flight conditions to the flight crew. The unit is connected to engine fuel flow transducers. The unit is capable of transmitting fuel information to certain GPS receivers for additional calculations and display of fuel management data. The unit can display engine fuel flow, fuel used, fuel remaining, and endurance. The unit does not interface with an aircraft's fuel quantity indicating system. The unit requires the flight crew to enter the initial fuel on board the aircraft. All calculations and data provided by the unit are based on fuel flow. Between power cycles, the unit retains the last fuel used and fuel remaining.

3.2.1. Shadin Fuel Flow Indicator Data Recovery

The fuel flow indicator sustained severe impact damage during the accident (figure 2). The indicator's non-volatile memory device was removed and installed in a laboratory surrogate indicator. Upon applying power, only error messages were indicated (figure 3).



Figure 2. Damaged Shadin Fuel Flow indicator.



Figure 3. Shadin Fuel Flow indicator, powered up.

3.3. Time Correlation

The JPI EDM-760 records time with the first data sample based on the unit's internal clock. This clock is set and updated by the operator. This time appeared to be set to Eastern Daylight time.

3.4. Plots and Corresponding Tabular Data

Figure 4 contains engine data for the entire accident flight. Figure 5 contains data from the last 20 minutes of the accident flight.

The corresponding tabular data used to create these plots are provided in electronic (*.csv²) format as Attachment 1 to this report.

² Comma Separated Value format.

Piper PA-60 Aerostar, C-GRRS

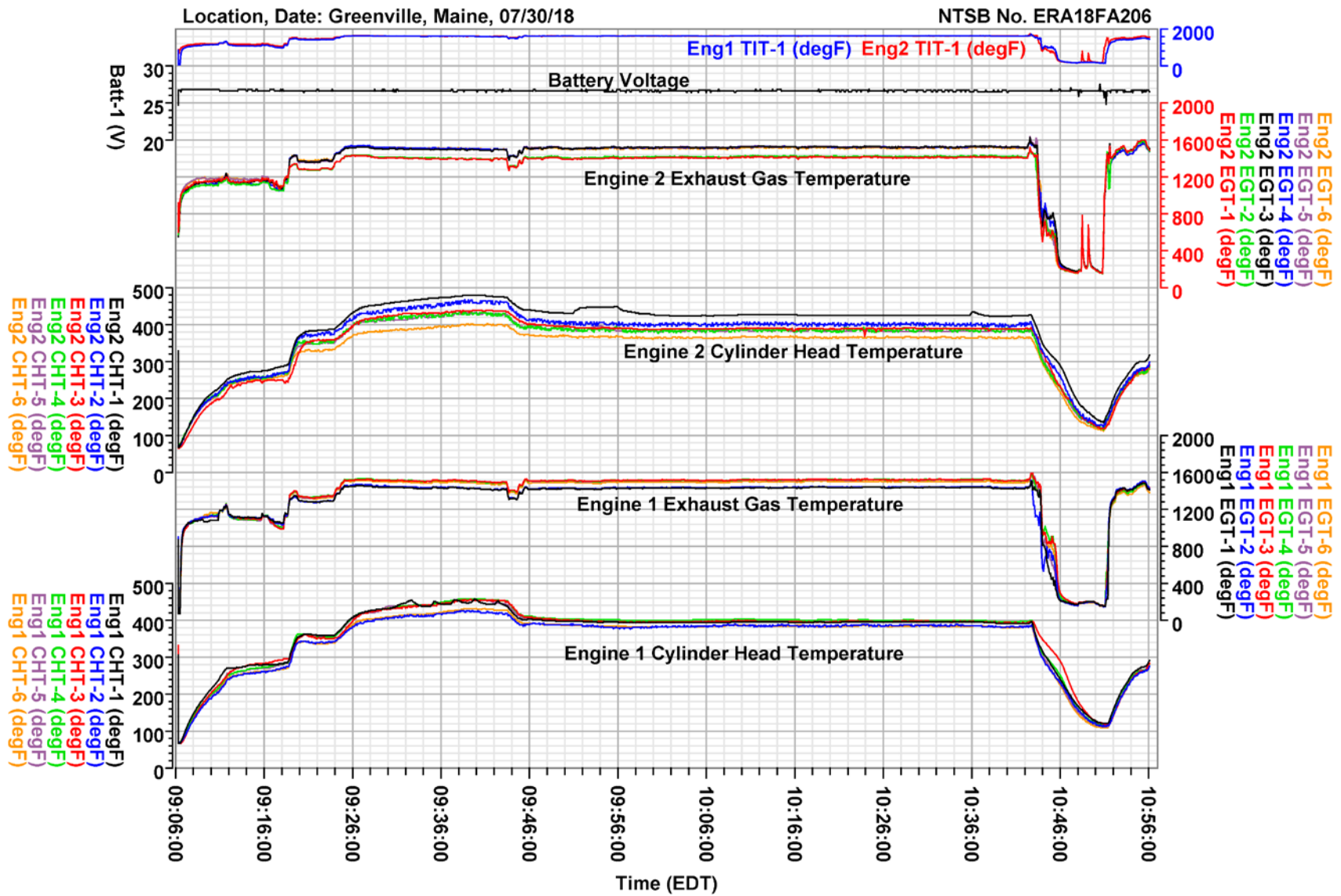


Figure 4. Engine data during entire accident flight.

Piper PA-60 Aerostar, C-GRRS

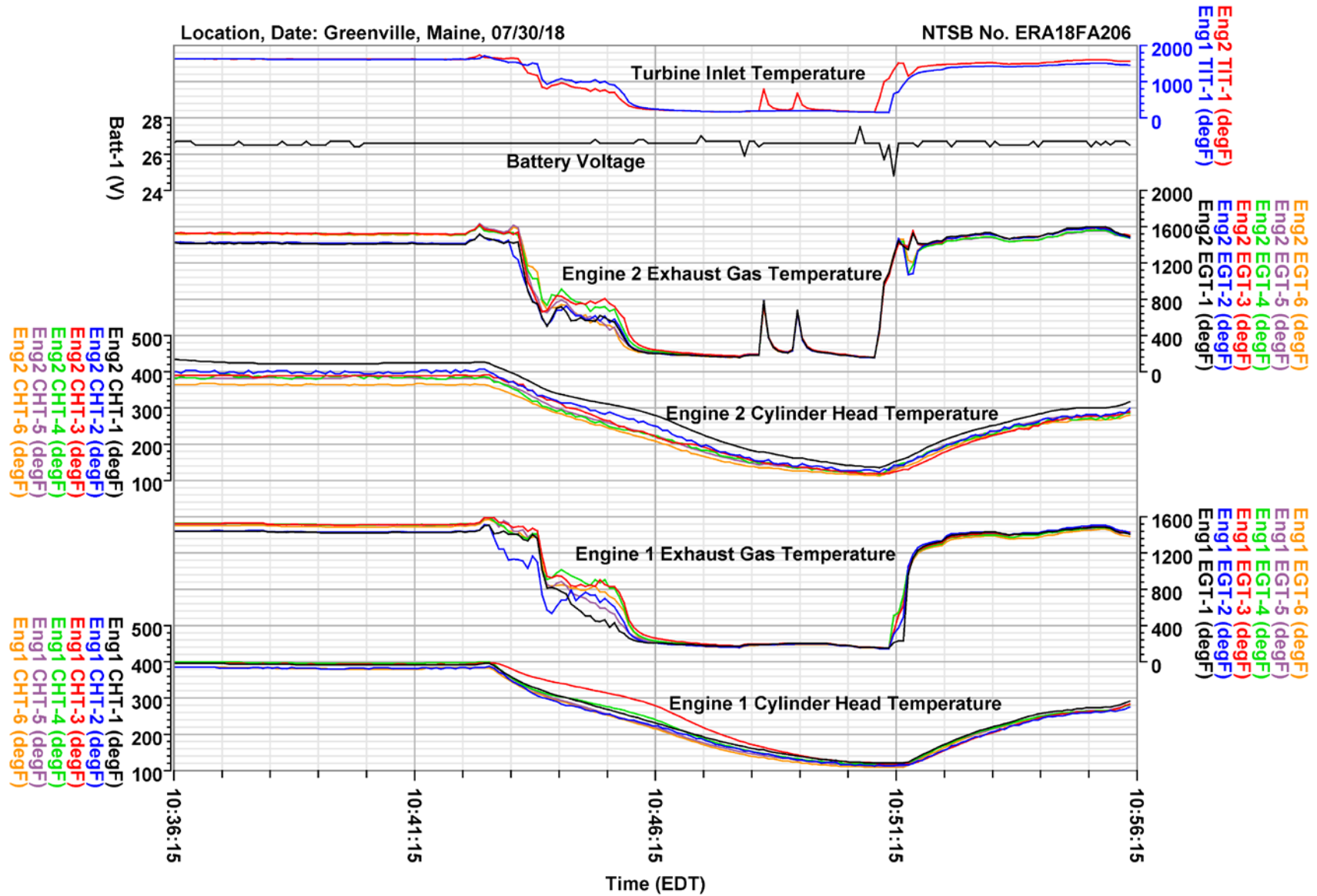


Figure 5. Engine data for end of accident flight.

APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the parameters and table A-2 describes the unit abbreviations used in this report.

Table A-1. Verified and provided parameters.

Parameter Name	Parameter Description
1. Batt-1 (V)	Battery Voltage Input 1
2. Eng1 CHT-# (degF)	Engine 1 Cylinder Head Temperature Cylinder # ^A
3. Eng1 EGT-# (deg)	Engine 1 Exhaust Gas Temperature Cylinder # ^A
4. Eng1 TIT-1 (deg)	Engine 1 Turbine Inlet Temperature
5. Eng2 CHT-# (degF)	Engine 2 Cylinder Head Temperature Cylinder # ^A
6. Eng2 EGT-# (degF)	Engine 2 Exhaust Gas Temperature Cylinder # ^A
7. Eng2 TIT-1 (degF)	Engine 2 Turbine Inlet Temperature

^A Indicates cylinder number

Table A-2. Unit abbreviations.

Units Abbreviation	Description
degF	Degrees Fahrenheit
V	Volts DC